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10/789,998	03/02/2004	Takafumi Terahara	1344.1134	3584
21171	7590	11/14/2006	EXAMINER	
STAAS & HALSEY LLP SUITE 700 1201 NEW YORK AVENUE, N.W. WASHINGTON, DC 20005			LIU, LI	
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			2613	

DATE MAILED: 11/14/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/789,998

Applicant(s)

TERAHARA, TAKAFUMI

Examiner

Li Liu

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 March 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 March 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- 1) ☒ Certified copies of the priority documents have been received.
 - 2) ☐ Certified copies of the priority documents have been received in Application No. _____.
 - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 03/02/2004.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement (IDS) submitted on March 2, 2004 is being considered by the examiner.

Drawings

2. The drawings are objected to because Figure 10 contains non-English characters.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-3 are rejected under 35 U.S.C. 102(b) as being anticipated by McMahon (US 5,208,692).

1). With regard to claim 1, McMahon discloses a multi-directional optical branching apparatus (the “transmultiplexer” 14 in Figure 2, column 4 line 26-44, and Figure 4), connected to N ($N \geq 3$) optical transmission paths (6 in Figure 4; four input/output ports are presented in Figure 4, $N=4$) each having a pair of optical paths corresponding to an up-link (12a in Figure 4) and a down-link (12 in Figure 4) which transmit wavelength division multiplexed signal lights in mutually different directions, for demultiplexing (22a in Figure 4) a wavelength division multiplexed signal light input from an input side optical path of each of optical transmission paths into N-1 wavelength groups (the three output groups: “1”, “2” and “3”), and then multiplexing (22b in Figure 4) each demultiplexed group with optical signals of different wavelength groups from other directions to output the multiplexed signal light to each output side optical path of a predetermined optical transmission path, comprising:

2xN optical multiplexing/demultiplexing devices (22 in Figure 4; 4 input/output ports, 8 multiplexer/demultiplexer) each including one common port (the input port of

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multiplexer 22a, and the output port of demultiplexer 22b) which is connected in one to one with any one of the input side optical paths (the input port of multiplexer 22a is connected to the downlink 12, one to one) or the output side optical paths (the output port of demultiplexer 22b is connected to the uplink 12a, one to one) of said N optical transmission paths, and N-1 branch ports (e.g, 3 output from the demultiplexer 22a), and being capable of demultiplexing a wavelength division multiplexed signal light input to the common port into the respective wavelength groups (column 8 line 28-64), to output from the corresponding branch ports (the ports 1,2 and 3 of demultiplexer 22a in Figure 4), and also multiplexing the optical signals (the multiplexer 22b multiplexes the signals), which belong to the respective wavelength groups (column 8 line 28-64), input to the branch ports (the branch ports 1,2 and 3 of demultiplexer receive the signal from other ports), to output from the common port (the output port of multiplexer 22b, which connected to the fiber 12a); and

a branch port connecting section (the fiber connections in Figure 4, or inside of the circle in Figure 3) that connects in one to one between the respective branch ports (the branch ports 1, 2 and 3 in Figure 4) of said $2 \times N$ optical multiplexing/demultiplexing devices, in accordance with previously set connection rules (column 4 line 26-57 and column 8 line 28-64).

2). With regard to claim 2, McMahon discloses a multi-directional optical branching apparatus, wherein said branch port connecting section connects in one to one between the respective branch ports of said $2 \times N$ optical multiplexing/demultiplexing devices, to satisfy simultaneously;

a first connection rule in that branch ports (the port 1, 2 and 3 in Figure 4) of an optical multiplexing/demultiplexing device where a common port (the port connected to 12 in Figure 4) thereof is connected with an input side optical path of one optical transmission path among said N optical transmission paths, are connected in one to one with branch ports of an optical multiplexing/demultiplexing device (e.g., the branch ports 1, 2 and 3 in group 6 are respectively connected to group 6b, 6c and 6c) where a common port thereof is connected with an output side optical path of another optical transmission path (the input port of multiplexer 22a or the output port of 22b is connected to the downlink 12 or uplink 12a, one to one);

a second connection rule in that branch ports corresponding to the same wavelength group are connected with each other (Figure 4, same wavelength group are used to connect the branch ports, "1" to "1", "2" to "2" and "3" to "3", column 8 line 28-64); and

a third connection rule in that, for all of combinations where any two are selected from among said N optical transmission paths, between respective branch ports are connected so that the up-link path and the down-link path are respectively linked (Figure 4, the branch ports of **multiplexer 22a**, which in turn is connected to uplink 12a, are connected to the branch ports of the **demultiplexer 22b** which is in turn connected to downlink 12, so the the up-link path and the down-link path are respectively linked).

3). With regard to claim 3, McMahon discloses a multi-directional optical branching apparatus,

wherein said N-1 wavelength groups are set so that the number of wavelengths of the optical signals in the wavelength group allocated to the up-link, and the number of wavelengths of the optical signals in the wavelength group allocated to the down-link, become the same (four input/output ports are presented in Figure 4; 3 wavelengths are used for the connection, same number of wavelengths are used for uplink and downlink, column 8 line 28-64).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over McMahon (US 5,208,692).

McMahon discloses all of the subject matter as applied to claim 1 above, and McMahon discloses the multiplexing/demultiplexing devices (22a and 22b in Figure 4). But McMahon does not expressly disclose that (A) the optical multiplexing/demultiplexing devices use WDM **couplers** which perform multiplexing/demultiplexing of optical signals, with an adjacent plurality of optical signals of wavelengths, contained in each transmission region, of light passing characteristics corresponding to respective branch ports, as a single wavelength group; (B) wherein said optical multiplexing/demultiplexing devices use optical **interleavers** each having

light passing characteristics which are periodically varied in a comb teeth shape corresponding to the respective branch ports, which alternately multiplex/demultiplex optical signals arranged at equal wavelength intervals.

By using the coupler, the demultiplexed channels can be grouped in " $\lambda_1, \lambda_2, \lambda_3$ " and " $\lambda_4, \lambda_5, \lambda_6$ "; and if using a interleaver, the demultiplexed channels can be grouped in " $\lambda_1, \lambda_3, \lambda_5$ " and " $\lambda_2, \lambda_4, \lambda_6$ ". Although McMahon does not specifically disclose the coupler or interleaver such limitation are merely a matter of design choice and would have been obvious in the system of McMahon. McMahon teaches that the multiplexing/demultiplexing devices separate or combine the wavelength groups. The limitations in claims 4 and 5 do not define a patentably distinct invention over that in McMahon since both the invention as a whole and McMahon are directed to multiplexing or demultiplexing signals. Since the coupler and interleaver have been widely used in the art for separating and combining wavelengths, the system of McMahon is fully capable to be made to do so. Therefore, to use coupler or interleaver or other kind of multiplexer/demultiplexer would have been a matter of obvious design choice to one of ordinary skill in the art.

7. Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over McMahon (US 5,208,692) as applied to claim 1 above, and in view of Ahmadvand et al (US 6,754,411).

1). With regard to claims 6, McMahon discloses all of the subject matter as applied to claim 1 above, McMahon discloses the multiplexing/demultiplexing devices (22a and 22b in Figure 4). But McMahon does not expressly disclose wherein when

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$N \geq 4$, for said optical multiplexing/demultiplexing devices, one common port and $N-1$ branch ports are formed by cascade connecting a plurality of devices each having one common port and two branch ports.

However, the cascading of two or more multiplexers/demultiplexers is a common practice in the art, as disclosed by Ahmadvand et al (Figure 3). Ahmadvand et al's devices relaxes the requirement of having very sharp frequency response in the first demultiplexer of the tree structure.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the cascading of multiplexing/demultiplexing devices as taught by Ahmadvand et al to the system of McMahon so that more freedom of allocating the channels can be obtained and the requirement of having very sharp frequency response in the demultiplexer/multiplexer can be relaxed.

2). With regard to claims 7, McMahon discloses all of the subject matter as applied to claims 1 and 5 above. And McMahon discloses the multiplexing/demultiplexing devices (22a and 22b in Figure 4). But McMahon does not expressly disclose wherein, when the physical branch ports formed by cascade connecting the optical multiplexing/demultiplexing is M ($M > N-1$), said branch port connecting section groups two or more branch ports of said M branch ports, and virtually considers these as N branch ports, and connects between each of the branch ports.

However, the cascading of two or more multiplexers/demultiplexers is a common practice in the art, as disclosed by Ahmadvand et al (Figure 3). Ahmadvand et al's

devices relaxes the requirement of having very sharp frequency response in the first demultiplexer of the tree structure. In Ahmadvand et al's system (Figure 3), MZI 21 has two outputs and MZI 22 has two outputs, so total 4 ($M = 4$) physical branch ports are formed by MZI 21 and MZI 22. In McMahon's system, four input/output ports $N = 4$, so the $M > N-1$. Therefore, when a similar cascading device is used in the system of McMahon, the two outputs from MZI 21 can be grouped together and connected to other ports, so to form a "virtually" N branch ports.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the cascading of multiplexing/demultiplexing devices taught by Ahmadvand et al to the system of McMahon so that more freedom of allocating the channels can be obtained and the requirement of having very sharp frequency response in the demultiplexer/multiplexer can be relaxed.

8. Claims 8-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over McMahon (US 5,208,692) as applied to claim 1 above, and in view of Park et al (US 2003/0058497).

1). With regard to claims 8 and 9, McMahon discloses all of the subject matter as applied to claim 1 above. But McMahon does not disclose the multi-directional optical branching apparatus, further comprising: (A) $2 \times N$ power adjusting devices provided on the respective optical paths connecting between the respective branch ports of said optical multiplexing/demultiplexing devices, which adjust the power of optical signals being propagated within said optical path; (B) optical spectrum monitor sections that respectively monitor the optical spectrums of the wavelength division multiplexed signal

lights output from common ports of said optical multiplexing/demultiplexing devices to the output side optical paths of said optical transmission paths; and (C) control sections that respectively control said power adjustment devices in accordance with the monitor result of said optical spectrum monitor sections, so that the average power of the optical signals belonging to said respective wavelength groups are approximately the same; and (D) wherein said power adjusting devices are variable optical attenuators (claim 9).

However, Park et al, in the same field of endeavor, discloses an all-optical cross-connection (PXC). Park et al discloses: (A) and (D) power adjusting devices (the variable optical attenuator VOA 34 in Figures 2-5) provided on the respective optical paths connecting between the respective branch ports of the optical multiplexing/demultiplexing devices, which adjust the power of optical signals being propagated within said optical path ([0020] and [0040]); (B) optical spectrum monitor sections (the optical spectrum analyzer OSA 30 in Figures 2-5) that respectively monitor the optical spectrums of the wavelength division multiplexed signal lights output from common ports of said optical multiplexing/demultiplexing devices to the output side optical paths of said optical transmission paths ([0036], [0037] and [0040]); and (C) control sections (Controller 35 in Figures 2-5) that respectively control said power adjustment devices in accordance with the monitor result of said optical spectrum monitor sections, so that the average power of the optical signals belonging to said respective wavelength groups are approximately the same ([0020], [0037] and [0040]).

Park et al's controlling system provide optimum signal powers, signal to noise ratios, signal quality (Q), and reduces network operational cost, improves network reach

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and significantly enhances network agility (ABSTRACT and [0016]). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the power controlling system as taught by Park et al to the system of McMahon so that a high signal quality, low cost connection system can be obtained.

2). With regard to claims 10, McMahon in view of Park et al discloses all of the subject matter as applied to claims 1 and 8 above. But McMahon in view of Park does not disclose wherein said power adjusting devices are optical amplifiers.

It is well known in the art that the amplifier can be used to adjust the power of the signal, similar to the pre-amplifier 12 or amplifier 16 in Figures 2-4 of Park et al's system, the gain settings of these amplifiers are adjusted by the OSA. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the amplifier as taught by Park et al to the system of McMahon so that a high signal quality, low cost connection system can be obtained.

3). With regard to claims 11 and 12, McMahon in view of Park et al discloses all of the subject matter as applied to claims 1 and 8 above. But McMahon does not disclose (A) wherein said optical amplifiers are provided between the input side optical paths of said optical transmission paths, and the common ports of said optical multiplexing/demultiplexing devices connected with said input side optical paths; and (B) wherein said optical amplifiers are provided between the output side optical paths of said optical transmission paths, and the common ports of said optical multiplexing/demultiplexing devices connected with said output side optical paths (claim 12).

However, Park et al, in the same field of endeavor, discloses that (A) optical amplifiers (16 in Figures 2-5) are provided between the input side optical paths (the fiber 11a in Figure 2-5) of said optical transmission paths, and the common ports (the input port of demultiplexer 18) of said optical multiplexing/demultiplexing devices connected with said input side optical paths (amplifier 16 is between the input fiber 11a and demultiplexer 18); and (B) optical amplifiers (28 in Figures 2-5) are provided between the output side optical paths (the fiber 11a' in Figure 2-5) of said optical transmission paths, and the common ports (the output port of multiplexer 26 in Figures 2-5) of said optical multiplexing/demultiplexing devices connected with said input side optical paths (amplifier 28 is between the multiplexer 26 and output fiber 11a').

Park et al's controlling system provide optimum signal powers, signal to noise ratios, signal quality (Q), and reduces network operational cost, improves network reach and significantly enhances network agility (ABSTRACT and [0016]). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the amplifiers and the power controlling system as taught by Park et al to the system of McMahon so that a high signal quality, low cost connection system can be obtained.

4). With regard to claim 13, McMahon in view of Park et al discloses all of the subject matter as applied to claim 1 above. But McMahon does not disclose: (A) N optical amplifiers provided between the input side optical paths of said optical transmission paths, and the common ports of said optical multiplexing/demultiplexing devices connected with said input side optical paths; (B) optical power monitor sections

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that respectively monitor the total power of the wavelength division multiplexed signal lights output from said optical amplifiers; and (C) control sections that respectively control driving states of said optical amplifiers so that the total power of the wavelength division multiplexed signal lights monitored by said optical power monitor sections becomes constant at a predetermined level common to respective directions.

However, Park et al, in the same field of endeavor, discloses that (A) optical amplifiers provided between the input side optical paths of said optical transmission paths (16 in Figures 2-5), and the common ports of said optical multiplexing/demultiplexing devices connected with said input side optical paths (amplifier 16 is between the input fiber 11a and demultiplexer 18); (B) optical power monitor sections (the optical spectrum analyzer OSA 30 in Figures 2-5, [0036] and [0041]) that respectively monitor the total power of the wavelength division multiplexed signal lights output from said optical amplifiers; and (C) control sections (the OSA also controls the power of the amplifiers, [0036 and [0041]) that respectively control driving states of said optical amplifiers so that the total power of the wavelength division multiplexed signal lights monitored by said optical power monitor sections becomes constant at a predetermined level common to respective directions ([0036 and [0041]).

Park et al's controlling system provides optimum signal powers, signal to noise ratios, signal quality (Q), and reduces network operational cost, improves network reach and significantly enhances network agility (ABSTRACT and [0016]). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made

to apply the amplifier and power controlling system as taught by Park et al to the system of McMahon so that a high signal quality, low cost connection system can be obtained.

5). With regard to claim 14, McMahon in view of Park et al discloses all of the subject matter as applied to claims 1 and 13 above. But McMahon does not disclose wherein optical amplifiers are provided between the output side optical paths of said optical transmission paths, and the common ports of said optical multiplexing/demultiplexing devices connected with said output side optical paths.

However, Park et al, in the same field of endeavor, discloses that wherein optical amplifiers (28 in Figures 2-5) are provided between the output side optical paths (the fiber 11a' in Figure 2-5) of said optical transmission paths, and the common ports (the output port of multiplexer 26 in Figures 2-5) of said optical multiplexing/demultiplexing devices connected with said output side optical paths (amplifier 28 is between the multiplexer 26 and output fiber 11a').

Park et al's controlling system provides optimum signal powers, signal to noise ratios, signal quality (Q), and reduces network operational cost, improves network reach and significantly enhances network agility (ABSTRACT and [0016]). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the amplifiers and the power controlling system as taught by Park et al to the system of McMahon so that a high signal quality, low cost connection system can be obtained.

6). With regard to claim 15, McMahon in view of Park et al discloses all of the subject matter as applied to claims 1 and 13 above. And McMahon further discloses

wherein the multidirectional optical branching apparatus is used for an optical branching node (the transmultiplexer 12 is used as the optical branching node, Figures 2 and 9).

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Terahara et al (US 2002/0196489 and US 6452701) discloses a WDM communication network with a multi-directional branching system (Figures 15, 17 and 18).

Yamamoto et al (US 5,502,589) discloses an optical communication network and optical nodes.

Barnard et al (US 6,219,162) discloses methods for equalizing WDM systems.

Wu (US 6,731,424) discloses a dynamics gain flattening in an optical communication system.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Li Liu whose telephone number is (571)270-1084. The examiner can normally be reached on Mon-Fri, 8:00 am - 5:30 pm, alternating Fri off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ken Vanderpuye can be reached on (571)272-3078. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Li Liu
November 9, 2006



KENNETH VANDERPUYE
SUPERVISORY PATENT EXAMINER